

943. FOSSIL DECAPOD CRUSTACEANS FROM THE MANDA GROUP (MIDDLE EOCENE), KYUSHU, JAPAN

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Abstract. Five species, *Eucalliax yoshihiro* sp. nov., *Prohomola japonica* (Yokoyama, 1911) gen. nov., *Raninoides nodai* sp. nov., *Portunites kattachiensis* sp. nov. and *Branchioplax pentagonalis* (Yokoyama, 1911) comb. nov. are described from the Middle Eocene (Okinoshiman) Manda Group in Kattachi, Omuta City, Fukuoka Prefecture, Kyushu, Japan. The decapod fauna from the Manda Group is closely related to those from the western and central Tethyan realms.

Key words. Decapoda, Crustacea, new species, new genus, Manda Group, Middle Eocene, Kyushu.

Introduction

The Middle Eocene Manda Group (Nagao, 1926) is distributed in the Omuta district, Middle Kyushu. This group contains a rich marine fauna and there have been several palaeontological studies, such as molluscs by Yokoyama (1911), Nagao (1928), Mizuno (1963) and Tomida *et al.* (1992) *etc.*, and elasmobranchs by Yabumoto (1989). The first crabs to be described were *Homolopsis japonicus* Yokoyama, 1911 and *Xanthilites pentagonalis* Yokoyama, 1911 from the Miike Coalfield in Omuta City. Tomita *et al.* (1992) figured, but did not describe, three species of crabs as *Oncinopus* sp., *Carcinoplax* sp. and *Leucosia* sp., all from the Manda Group.

In this paper, I describe five species, three new, in five genera of decapods from the Manda Group, collected by S. Noda. In addition, Yokoyama's two species from the Manda Group are redescribed, a new genus, *Prohomola*, is proposed to accommodate

Homolopsis japonicus Yokoyama, 1911, and the palaeobiogeography of the species involved is discussed.

Specimens prefixed KMNH IVP are in the Kitakyushu Museum of Natural History (6, Nishihonmachi 3-chome, Yahatahigashiku, Kitakyushu, 805), ESN80005 is in the Department of Earth and Planetary Sciences, School of Science, Nagoya University (Chikusa, Nagoya, 464-01), and others are in the Noda collection (294, Miike, Omuta, 837).

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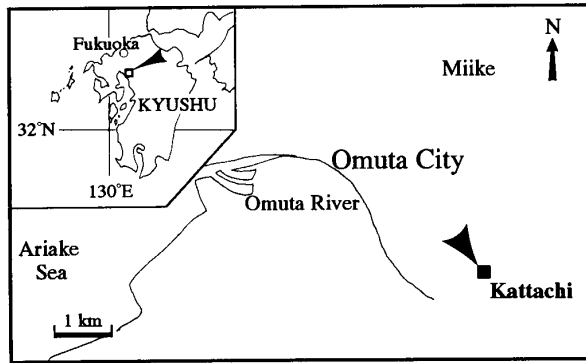


Figure 1. Locality map.

study.

Locality and geologic note

The Middle Eocene decapods were collected from the Kattachi Formation, Manda Group exposed at Kattachi (130°28'52"E, 33°00'45"N), Omuta City (Figure 1). In this area, the Manda Group overlying the Omuta Group, is divided into the Kattachi and Yotsuyama Formations in ascending order (Nagao, 1926; Matsushita, 1949; Tomida *et al.*, 1992). According to Mizuno (1962, 1964), the Manda Group is correlated with the Okinoshiman stage, set chronologically by Ozaki *et al.* (1991) and Mizuno (1992) in the late Middle Eocene (Bartonian).

Decapods occur in nodules of the lowermost sandstone of the Kattachi Formation in association with many molluscs, *Crassatellites fuscus* Yokoyama, *Venericardia nipponica* Yokoyama, *V. mandarina* (Yokoyama), *Mazzalina miikensis* (Nagao), *Perotrochus eocenicus* Kuroda and Urata, *Aturia nagaoi* Kobayashi, *A. matsushitai* Kobayashi, and elasmobranchs, *Carcharodon nodai* Yabumoto, *Striatolamina macrotia* (Agassiz).

Systematic Palaeontology

Infraorder Thalassinidea Latreille, 1831
 Superfamily Axioidea Huxley, 1879
 Family Callianassidae Dana, 1852
 Subfamily Eucalliinae Manning
 and Felder, 1991

Genus *Eucalliax* Manning and Felder, 1991

Type species.—By original designation *Callianassa quadracuta* Biffar, 1970.

Geologic range.—Eocene to Recent.

Eucalliax yoshihiro sp. nov.

Figures 2-1-6; 3-1-4

Etymology.—From Yuei Yoshihiro who collected the type specimen.

Diagnosis.—Chelipeds large, heterochelate; propodus of major cheliped sparsely granulate on mesial and lateral surfaces; palm slightly broader than long; minor cheliped slightly shorter than major cheliped; propodus also sparsely granulate on mesial and lateral surfaces; fingers elongate, longer than palm; carpus short; merus rhomboidal, with longitudinal carina on lateral surface.

Description.—The chelipeds are large and heterochelate. The propodus of the major cheliped is about 1.6 times longer than broad. The sharp dorsal and mesial margins are dentate. The gently convex mesial and lateral surfaces are sparsely granulate distally. The palm is slightly broader than long and about 1.3 times the length of the fixed finger. The propodus of the minor cheliped is slightly shorter and more slender than that of the major cheliped. The propodus which is twice as long as broad bears irregular denticles on the ventral and dorsal margins, and is sparsely ornamented with granules on the lateral and mesial surfaces, distally. The palm is about 1.2 times broader than long and shorter than the elongate fixed finger. The carpus is short. The merus, with a longitudinal carina on the lateral surface, is rhomboidal in lateral view and longer than broad.

The 6th abdominal somite is slightly wider than long. There are two transverse sutures extending one-fifth of the width on each side at the distal third, and they unite with longitudinal sutures. On the posterior margin, a central suture reaches the horizontal suture.

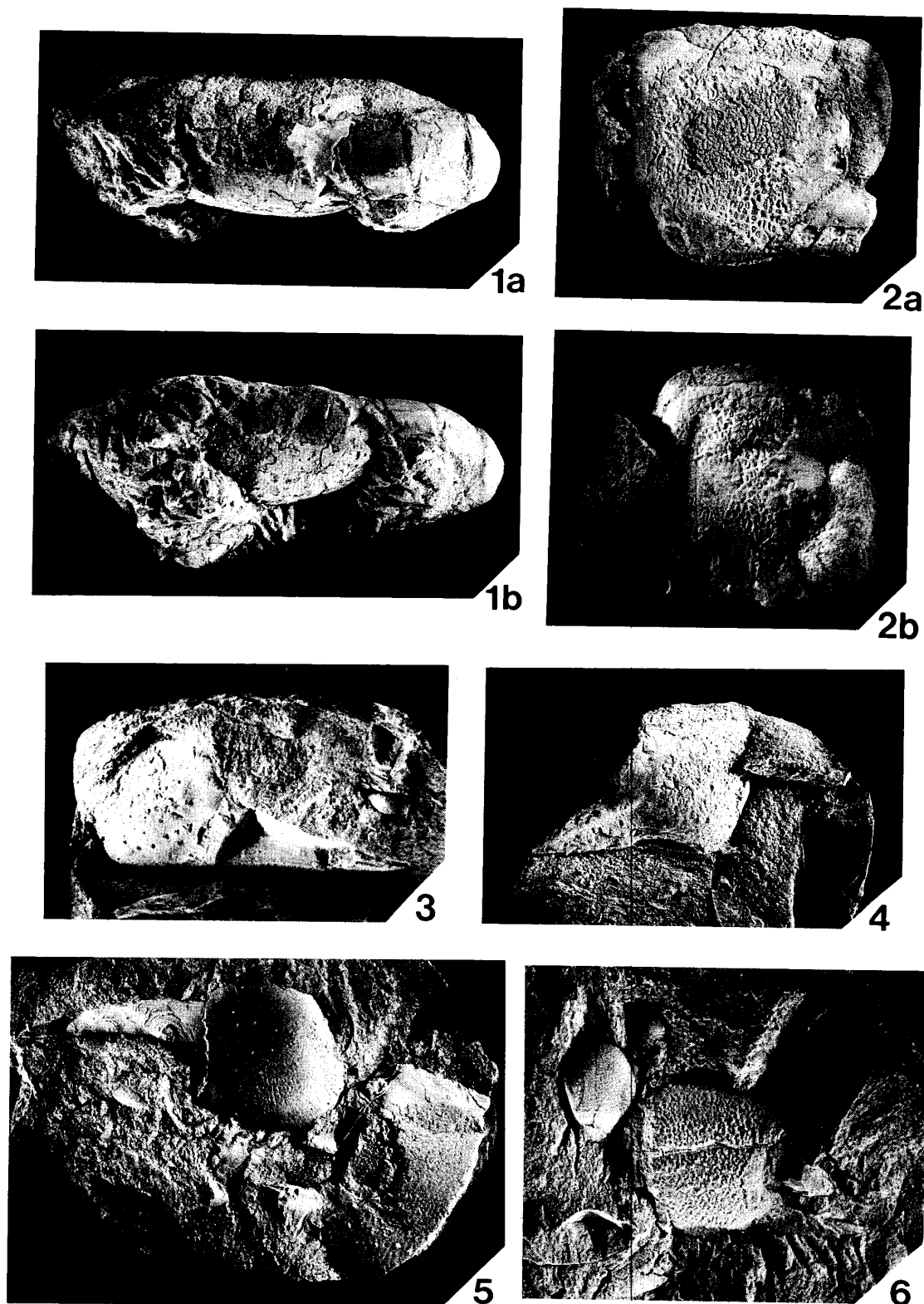


Figure 2. *Eucalliax yoshihiroii* sp. nov. 1, branchial region and abdominal segments, Noda collection (5954), a, dorsal ; b, left view. 2, propodus of right cheliped, paratype (KMNH IVP 300,002), a, lateral ; b, mesial view. 3, propodus of right cheliped, paratype (KMNH IVP 300,003), lateral view. 4, propodus of left cheliped, paratype (KMNH IVP 300,004), lateral view. 5, propodus of left and right chelipeds, holotype (KMNH IVP 300,001). 6, right cheliped, paratype (KMNH IVP 300,005). All figures $\times 1.5$.

Discussion.—The present new species is readily distinguished from the Late Eocene *Callianassa muratai* Nagao, 1932 and *C. elongatodigitata* Nagao, 1941 from Hokkaido in that the palm of the major cheliped is shorter and the minor cheliped is larger.

This species is one of the dominant elements from the Kattachi Formation, Manda Group.

Repository.—KMNH IVP 300, 001 (Holotype); KMNH IVP 300, 002–300, 009 (Paratypes); Noda collection (5954).

Infraorder Brachyura Latreille, 1803

Section Podotremata Guinot, 1977

Subsection Archaeobrachyura Guinot, 1977

Superfamily Homoloidea de Haan, 1839

Family Homolidae de Haan, 1839

Genus *Prohomola* gen. nov.

Type species.—By monotypy *Homolopsis japonicus* Yokoyama, 1911; Middle Eocene, Japan; gender, feminine.

Etymology.—Indicating an early member of the *Homola* Group.

Diagnosis.—Carapace longitudinally ovate, tapering anteriorly; dorsal surface flattened, granulated, without spines; mesogastric lobe with a median tubercle; rostrum slender, simple, downturned; pseudorostral spine triangular, short, projecting dorsally.

Discussion.—In the outline of the carapace, the present new genus resembles *Paromola* Wood-Mason and Alcock, 1891 *emend.* Guinot and Forges (in press), but differs in having the dorsal surface without spines and a short pseudorostral spine which does not overreach the rostral spine. *Prohomola* gen. nov. is easily distinguished from the only other hitherto known Palaeogene homolid genus *Palehomola* Rathbun, 1926 because in *Palehomola* the rostrum consists of two horns. *Prohomola* has pseudorostral spines and the mesogastric lobe has a median tubercle, whereas the mesogastric lobe of *Homolopsis* Bell, 1863 and *Zygastrocarcinus* Bishop, 1983 has three nodes arranged in a triangle

and there are no pseudorostral spines.

Geologic range.—Late Middle Eocene (Okinoshiman).

Prohomola japonica (Yokoyama, 1911)
comb. nov.

Figures 3–5—7

Homolopsis japonicus Yokoyama, 1911, p. 12, pl. 3, fig. 4.

Paromola japonicus (Yokoyama). Jenkins, 1977, p. 4. (non *Paromola japonica* Parisi, 1915)

Oncinopus sp. Tomita *et al.*, 1992, pl. 17, fig. 10.

Zygastrocarcinus japonica (Yokoyama). Bishop and Brannen, 1992, p. 321.

Diagnosis.—As for genus.

Description.—The carapace is longitudinally ovate in outline and tapers anteriorly. The forwardly directed rostrum is downturned, slender and simple. The robust pseudorostral spines are short, triangular, and project dorsally. The anterolateral margins with a sharp epibranchial spine, are gently convex. The irregularly tuberculated posterolateral margins are gently rounded. The flattened dorsal surface is ornamented with granules which vary in size. The regions are well defined. A deep groove separates the slightly swollen protogastric lobes, each with two nodes transversely arranged, from the anterior mesogastric process. There is a large median tubercle on the slightly convex mesogastric lobe. The inflated urogastric lobe is bilobed. The narrow cardiac lobe, with a shallow median depression, is longitudinally vaulted. The cervical and branchiocardiac grooves are well developed. Two nodes one above the other are present on the gently convex hepatic lobe. The gently elevated epibranchial lobes, divided by a shallow oblique groove, are bounded by the cervical, branchiocardiac and gastrocardiac grooves. The mesobranchial lobes are gently convex. The metabranchial lobes are separated from the cardiac region by deep postcardiac markings and the intestinal lobe is flattened. The *linea homolica* is present.

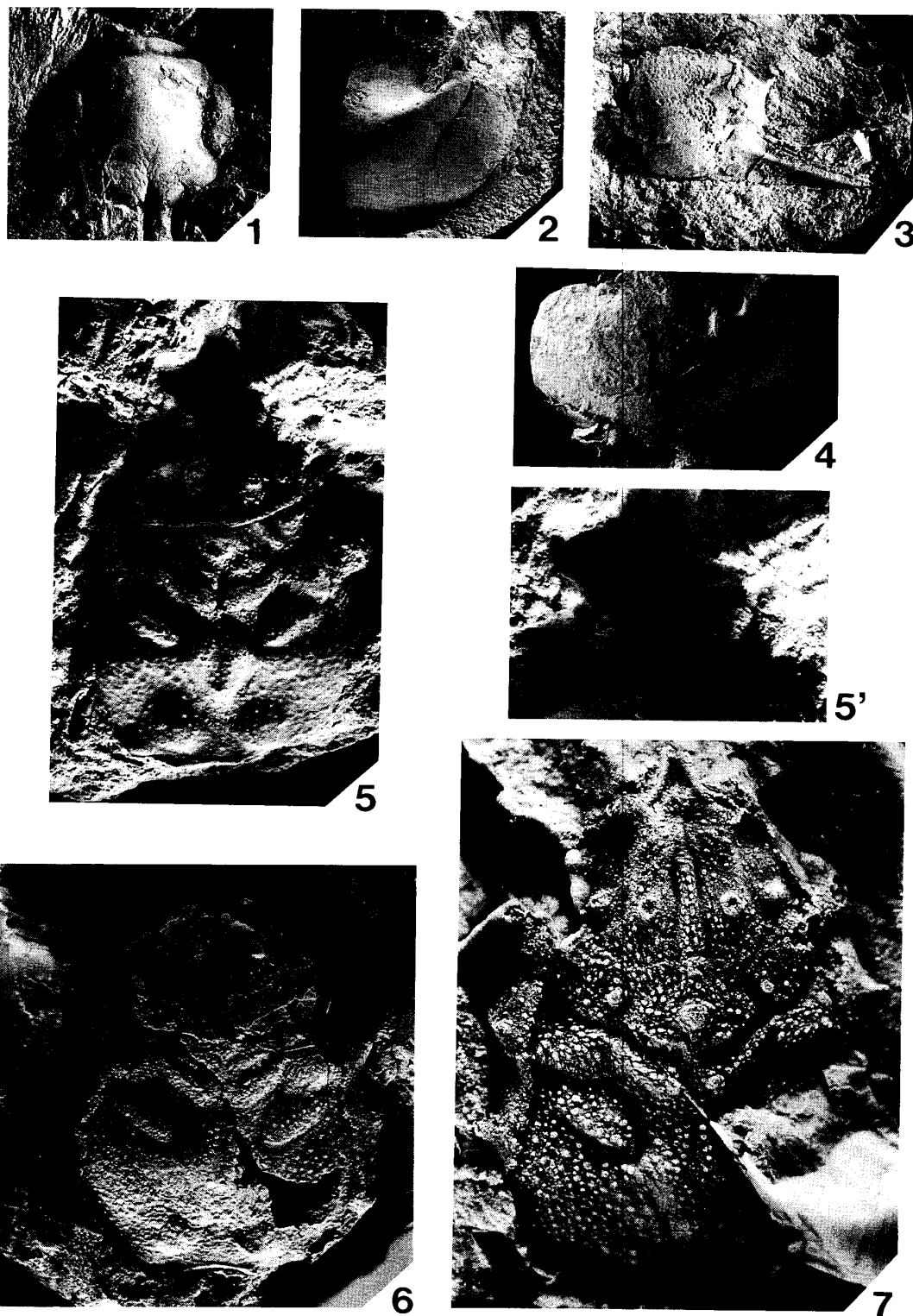


Figure 3. 1-4, *Eucalliax yoshihiroii* sp. nov. 1, sixth abdominal segment, paratype (KMNH IVP 300,006), $\times 2.3$, dorsal view. 2, merus of left cheliped, paratype (KMNH IVP 300,007), $\times 2.0$, lateral view. 3, propodus of right cheliped paratype (KMNH IVP 300,008), $\times 1.5$, lateral view. 4, carpus of right cheliped, paratype (KMNH IVP 300,009), $\times 2.8$, lateral view. 5-7, *Prohomola japonica* (Yokoyama, 1911) gen. nov. 5, carapace, Noda collection (5988), $\times 2.8$, dorsal view. 5', rostrum of figure 5, $\times 6.2$. 6, carapace, KMNH IVP 300,010, $\times 3.2$, dorsal view. 7, plaster cast of outer mould of KMNH IVP 300,010, $\times 4.8$, dorsal view.

Remarks.—Yokoyama's (1911) original description of this species was founded on a single specimen taken at a depth of 489 feet from a shaft at the Miike Coalfield.

Repository.—KMNH IVP 300, 010; Noda collection (5988).

Superfamily Raninoidea de Haan, 1839

Family Raninidae de Haan, 1839

Genus *Raninoides* H. Milne Edwards, 1837

Type species.—By monotypy *Ranina laevis* Latreille, 1825.

Geologic range.—Eocene to Recent.

Raninoides nodai sp. nov.

Figures 4-2—8

Etymology.—From Sakae Noda who collected the type specimen.

Diagnosis.—Carapace longitudinally ovoid; dorsal surface smooth, with a weak median ridge; orbitofrontal margin 0.75 of carapace width; anterolateral margin with long hepatic spine.

Description.—The carapace is longitudinally ovoid in outline and the length, excluding the hepatic spine, is 1.5–1.6 times the width. The finely granulated dorsal surface with a weak median ridge, is slightly convex longitudinally. The regions are not defined. The posterior gastric pits are present and attractor epimeralis muscle scars are weakly marked. The wide orbitofrontal margin occupies 0.75 of the carapace width. The triangular rostrum is flattened and as long as wide at the base. There are two deep fissures in the upper orbital margin and the U-shaped inner fissure is deeper than the V-shaped outer one. The outer orbital spine is bifid; the external branch, directed laterally, is broadly triangular in outline and longer than the sharply triangular internal branch. The inner orbital spine on either side of the rostrum is shorter than the outer orbital spine and directed obliquely outwards. The anterolateral margins are convex and there is a long hepatic spine projecting forwards and

outwards. Sigmoid posterolateral margins converge posteriorly. The pterygostomial regions are inflated and the long buccal area tapers anteriorly.

Left and right chelipeds are present, but badly preserved. The propodus has two forwardly directed acutely triangular spines on the ventral margin and one on the dorsal margin. The sharp fixed finger is as long as the palm, strongly deflexed ventrally and has 6 teeth on the occludent margin. The slender dactylus is as long as the fixed finger and strongly down-curved.

Discussion.—The present new species closely resembles *Raninoides vaderensis* Rathbun, 1926 from the Eocene of North America, but differs in having a weak median ridge on the dorsal surface and a long hepatic spine. *R. nodai* sp. nov. appears to have a post-frontal ridge, but it is much weaker than that of *R. vaderensis*.

Raninoides nodai sp. nov. occurs in high density conditions at Kattachi.

Repository.—KMNH IVP 300, 011 (Holotype); KMNH IVP 300, 012–300, 015 (Paratypes); Noda collection (N676).

Section Heterotremata Guinot, 1977

Superfamily Portunoidea Rafinesque, 1815

Family Portunidae Rafinesque, 1815

Subfamily Carcininae MacLeay, 1838

Genus *Portunites* Bell, 1858

Type species.—By monotypy *Portunites incerta* Bell, 1858.

Geologic range.—Eocene to Miocene?

Portunites kattachiensis sp. nov.

Figures 5-1, 3

Etymology.—From “Kattachi”, a fossil-bearing locality name.

Diagnosis.—*Portunites* with nearly straight frontal margin with 4 blunt lobes, anterolateral margin bearing 5 teeth, the last produced laterally.

Description.—The carapace is hexagonal in

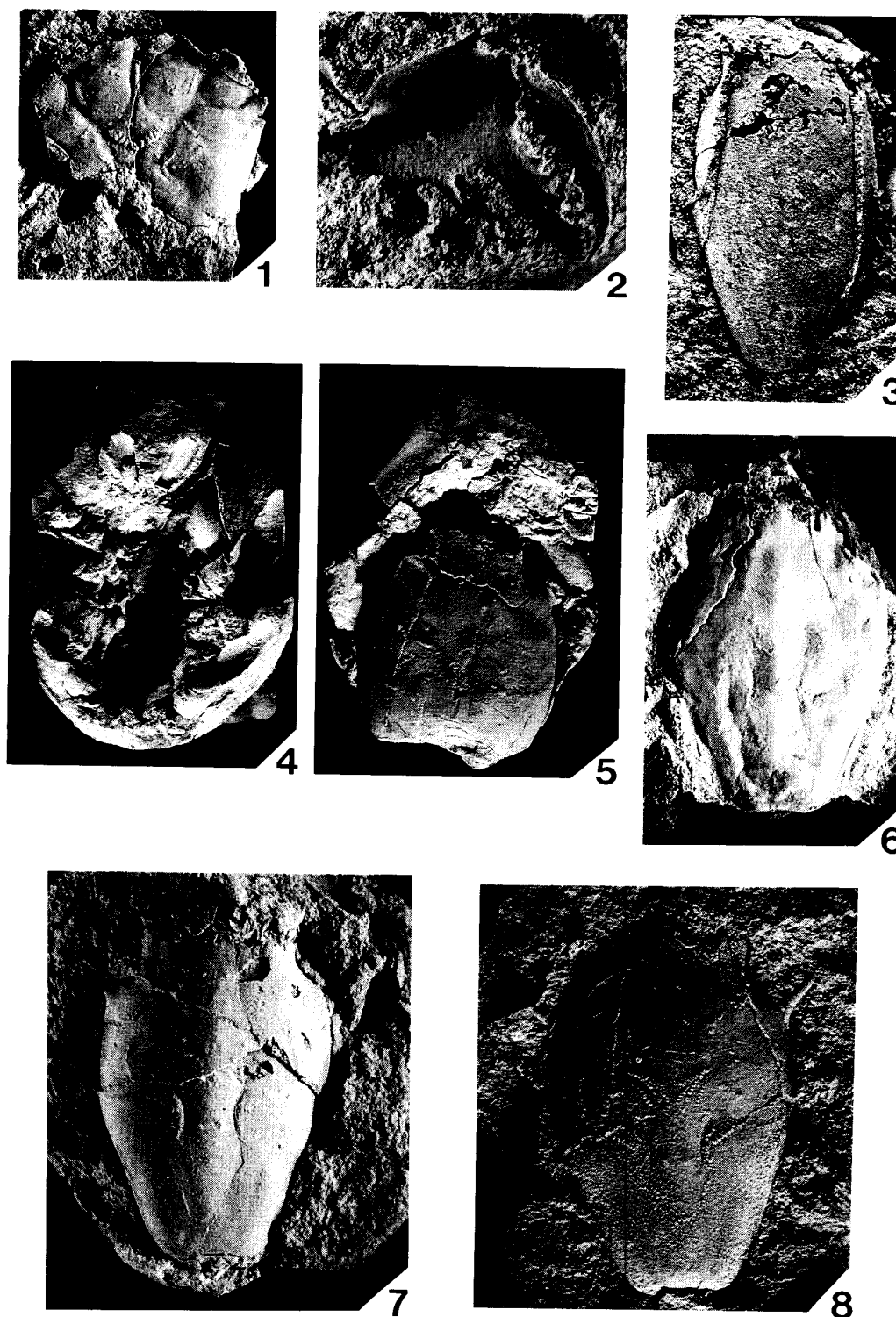


Figure 4. 1. *Branchioplax pentagonalis* (Yokoyama, 1911) comb. nov., carapace, KMNH IVP 300,017, $\times 1.5$, dorsal view. 2-8, *Raninoides nodai* sp. nov. 2, right cheliped, holotype, (KMNH IVP 300,011), $\times 3.8$, lateral view. 3, carapace, paratype (KMNH IVP 300,012), $\times 3.0$, dorsal view. 4, thoracic sterna and third maxillipeds, paratype (KMNH IVP 300,013), $\times 2.0$, ventral view. 5, carapace and left cheliped, paratype (KMNH IVP 300,014), $\times 1.5$, dorsal view. 6, carapace, paratype (KMNH IVP 300,015), $\times 1.5$, dorsal view. 7, carapace, holotype (KMNH IVP 300,011), $\times 2.0$, dorsal view. 8, carapace, Noda collection (N676), $\times 2.0$, dorsal view.

outline, the length is about 0.75 of the width. The finely granulated dorsal surface is moderately convex. The regions are well defined. The epigastric lobes are transversely ridged. Broad, deep grooves separate the more convex protogastric lobes from the anterior mesogastric process and mesogastric lobes. The gently swollen mesogastric lobe is divided by a shallow median groove. The inflated urogastric lobe is well defined and there is a small boss between the urogastric and cardiac lobes. The cardiac region is hexagonal in outline; it is subdivided by a shallow median depression and there are two nodes transversely arranged. A deep cervical groove separates the flattened hepatic lobes from the branchial regions. The epibranchial lobes are strongly developed into ridges arching forwards and outwards to reach the last anterolateral tooth. The otherwise depressed meso- and metabranchial lobes become tumid surrounding the cardiac region. The orbito-frontal margin occupies about half of the carapace width. The frontal margin, separated from a small supraorbital angle by a shallow V-shaped notch, is composed of four blunt lobes; the inner pair, set close together to a V-shaped median sinus are separated by a U-shaped notch from the bluntly triangular outer pair. The concave upper orbital margin is pierced laterally by two deep fissures. Gently arched anterolateral margins have five well separated triangular teeth; the first four are directed forwards and the fifth laterally directed. Gently concave posterolateral margins are as long as the anterolateral margins.

Discussion.—A thin orbital margin, a long anterolateral margin and protogastric lobes without transverse ridges easily distinguish the present new species from *Portunites hexagonalis* Nagao, 1941 from the Late Eocene Poronai Formation of Hokkaido. *P. katta-chiensis* sp. nov. resembles *P. sylviae* Quayle and Collins, 1981 from the Eocene Barton Beds of England, but differs in having a wider carapace, large protogastric lobes and the fifth anterolateral tooth is strongly projected.

Repository.—KMNH IVP 300, 016 (Holotype); Noda collection (5927).

Superfamily Xanthoidea MacLeay, 1838

Family Goneplacidae MacLeay, 1838

Subfamily Carcinoplacinae

H. Milne Edwards, 1852

Genus *Branchioplax* Rathbun, 1916

Type species.—By monotypy *Branchioplax washingtoniana* Rathbun, 1916.

Geologic range.—Eocene to Oligocene.

Branchioplax pentagonalis
(Yokoyama, 1911) comb. nov.

Figure 4-1; 5-4—6

Xanthilites pentagonalis Yokoyama, 1911, p. 13, pl. 3, fig. 3.

Carcinoplax sp., Tomita *et al.*, 1992, pl. 17, figs. 5-8.

Leucosia sp., Tomita *et al.*, 1992, pl. 17, fig. 9.

Diagnosis.—Carapace subquadrate, slightly wider than long; dorsal surface gently convex; regions well defined by shallow grooves; frontal margin straight with V-shaped median notch; orbital margin wide; anterolateral margin with five teeth. Chelipeds strongly heterochelate, covered with fine granules.

Description.—The carapace is subquadrate in outline and slightly wider than long. The finely granulated dorsal surface is gently convex. The regions are well defined by shallow grooves. The small epigastric lobes are gently raised transversely and the protogastric lobes are gently swollen and well separated from the slender anterior mesogastric process by rather deep grooves, whereas a boundary between the proto- and mesogastric lobes is indistinct. The flattened mesogastric lobe has two pairs of nodes on either side of the midline. The urogastric lobe is narrow and separated from the metabranchial lobes by deep epimeral adductor muscle scars. The cervical groove is conspicuous. There are three nodes set in an inverted triangle on the gently convex cardiac region. The flattened

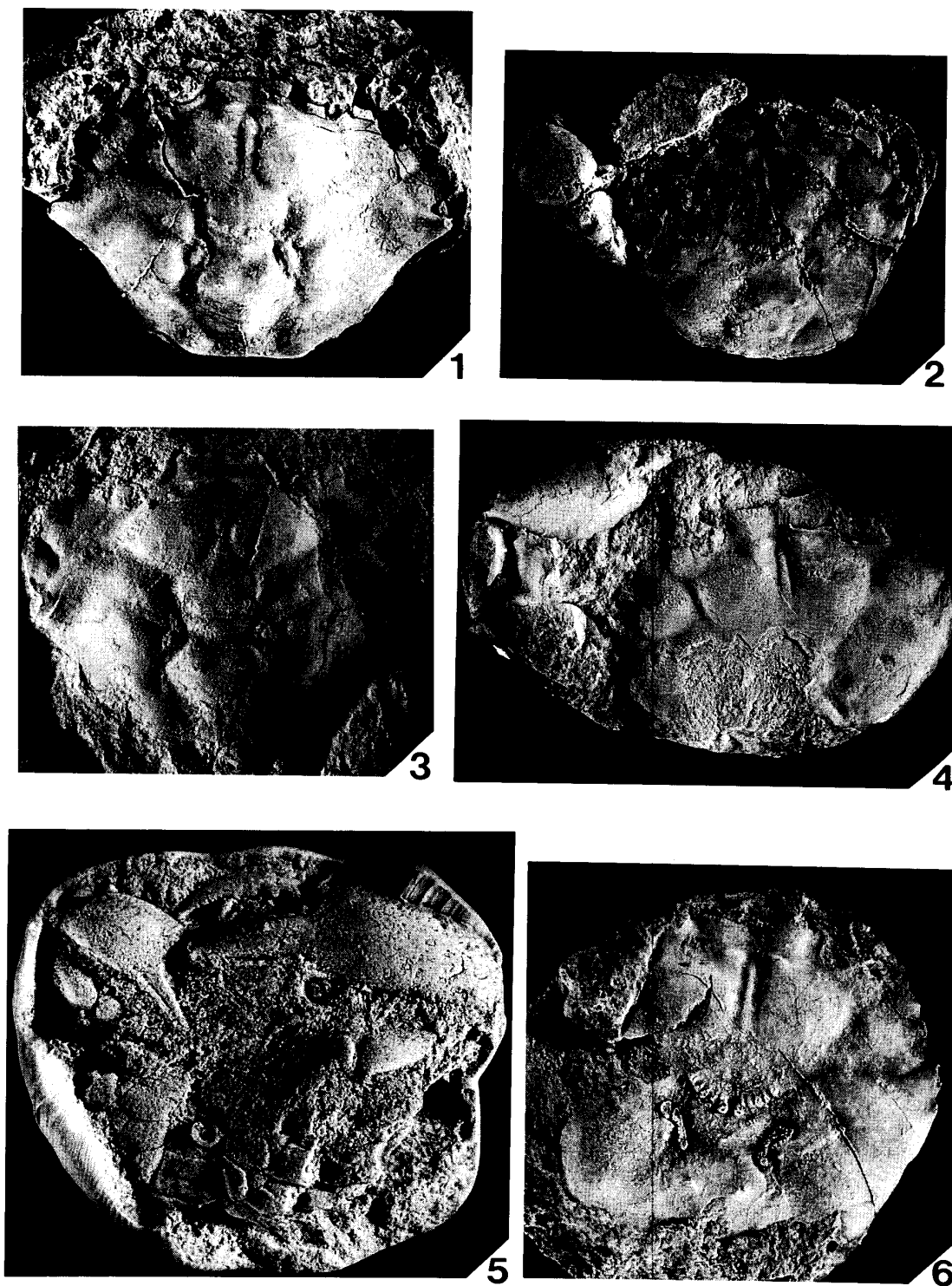


Figure 5. 1, 3, *Portunites kattachiensis* sp. nov. 1, carapace, $\times 2.0$, dorsal view, Noda collection (5927). 3, carapace, holotype (KMNH IVP 300,016), $\times 2.8$, dorsal view. 2, 4-6. *Branchioplax pentagonalis* (Yokoyama, 1911) comb. nov. 2, carapace and left cheliped, Noda collection (5927), $\times 1.2$, dorsal view. 4, carapace and left cheliped, KMNH IVP 300,018, $\times 1.5$, dorsal view. 5, left and right chelipeds, thoracic sterna and abdomen (plaster cast), KMNH IVP 300,019, $\times 1.5$, ventral view, 6, carapace, ESN 80005, $\times 2.0$, dorsal view.

intestinal lobe is small. Gently raised hepatic regions are well differentiated. The epibranchial lobes are gently swollen and arched anteriorly. The meso- and metabranchial lobes are also gently swollen. The orbitofrontal margin occupies 0.6–0.7 of the carapace width. The frontal margin is straight, divided medially by a V-shaped notch, and finely granulated, and a shallow sinus separates it from an obscure inner orbital angle. The upper orbital margin is wide and pierced by two shallow notches laterally. Gently arched anterolateral margins are 0.4 of the width; there are five teeth including the postorbital tooth; the 1st tooth is small and triangular in outline; the 2nd is the largest and broadly triangular in outline; the 3rd–5th are forwardly directed and acutely triangular in outline, and the 5th is smallest. Gently convex posterolateral margins are 1.2 times as long as the anterolateral margins and the posterior angle is broadly rounded into a slightly convex posterior margin.

Abdomen of male: The 7th somite is triangular in outline. The 6th, longest, is wider than long, with straight, parallel lateral margins. The 5th and 4th somites are also wider than long and their lateral margins taper anteriorly. The 3rd somite is narrow. The 2nd and 1st somites are not preserved.

Sternites 1 to 3 are missing and the 4th is broken; sternites 5 and 6 are wider than long; the 7th is narrower than the preceding two and the 8th is reduced in size.

The finely granulated chelipeds are strongly heterochelate, the major being rather more than half as long as the minor cheliped. The slender dactylus is gently curved ventrally and there seem to be four teeth diminishing in size distally on the occludent margin. The fixed finger is as long as the dactylus and possesses a longitudinal shallow groove on the ventrolateral surface. The palm is longer than the dactylus.

The pereopods are ovate in cross section.

Discussion.—Yokoyama (1911) originally

described this species on the basis of a single broken specimen obtained from a depth of 484 feet of a shaft at the Miike Coalfield. At that time, he considered the species to be most closely allied to *Xanthilites bowerbankii* Bell, 1858 from the Eocene of the Isle of Sheppey, England. Examination of a recently obtained well-preserved carapace, remaining associated chelipeds, thoracic sterna and a fragmentary abdomen indicate that this species should be transferred from *Xanthilites* Bell, 1858 to *Branchioplax* Rathbun, 1916. *B. pentagonalis* closely resembles *B. washingtoniana* Rathbun, 1916 from the Eocene of Alaska (Rathbun, 1926; Tucker and Feldmann, 1989), but differs in having a longer carapace and a finely granulated frontal margin which is separated from an obscure inner orbital angle by a shallow sinus. A longer carapace and five anterolateral teeth readily distinguish *B. pentagonalis* from *B. concinna* Quayle and Collins, 1981 from the Eocene Barton Clay of England. *B. pentagonalis* differs from *B. sulcata* Müller and Collins, 1991 from the Late Eocene Szépvölgy Formation of Hungary by having well defined dorsal regions of the carapace.

Repository.—KMNH IVP 300, 017–300, 019; ESN80005; Noda collection (5927).

Discussion

The Middle Eocene decapod fauna from the Manda Group is represented by five species; four species, *Callianassa muratai* Nagao, 1932, *C. elongatodigitata* Nagao, 1941, *Ranidina teshimai* Fujiyama and Takeda, 1980, and *Portunites hexagonalis* Nagao, 1941 have been described from the Late Eocene Poronai Formation of Hokkaido. Except for *Portunites*, decapods of the Manda Group have nothing in common with those of the Poronai Formation. In addition, the raninids are represented by different genera.

Both *Eucalliax* and *Raninoides* have living species, while *Prohomola*, *Portunites* and

Branchioplax are restricted to the Palaeogene. Whereas the fossil species of *Eucalliax* and *Prohomola* are endemic, those of *Raninoides*, *Portunites* and *Branchioplax* are recorded from the Palaeogene of North America, Central America, Senegal, England and Hungary (Rathbun, 1926; van Straelen, 1933; Remy and Tessier, 1954; Quayle and Collins, 1981; Müller and Collins, 1991). Accordingly, the occurrences of *Raninoides*, *Portunites* and *Branchioplax* show that the decapod fauna from the Middle Eocene Manda Group is related to the western and central Tethyan realms.

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万田層群産中期始新世十脚甲殻類：福岡県大牟田市勝立に分布する中部始新統（沖ノ島階）万田層群勝立層より産した3新種を含む5種の十脚甲殻類化石を記載する。それらは、*Eucalliax yoshihiro* sp. nov. (スナモグリ科), *Prohomola japonica* (Yokoyama) gen. nov. (ホモラ科), *Raninoides nodai* sp. nov. (アサヒガニ科), *Portunites kattachiensis* sp. nov. (ガザミ科), *Branchioplax pentagonalis* (Yokoyama) comb. nov. (エンコウガニ科) である。*Raninoides*, *Portunites*, *Branchioplax* 属の存在は、万田層群の十脚甲殻類ファウナが、古生物地理上、始新世における西部・中部テーチス地域の十脚甲殻類ファウナと関連があったことを示す。

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